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EXAMINER	
COUGHLAN, PETER D	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/627,355	Applicant(s) LLINAS ET AL.	
	Examiner PETER COUGHLAN	Art Unit 2129	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 March 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *12-46* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *12-46* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12/4/2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

Detailed Action

1. This office action is in response to an AMENDMENT entered March 11, 2009 for the patent application 10/627355 filed on July 24, 2003.

2. All previous Office Actions are fully incorporated into this Final Office Action by reference.

3. Examiner's Comment: Although, the terms 'carrier wave' or 'carrier signal' is not specifically mentioned within the specification, the Examiner will exclude these interpretations wherein the context of 'memory' is disclosed.

Status of Claims

4. Claims 12-46 are pending.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 19, 27, 36 and 44 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. These claims state that 'the step of creating a first cluster of control circuits and a second cluster of a control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster.' The claim language is very specific in this characteristic where as the specification is not as specific. The specification states that 'generally the coupling between units inside a cluster is stronger than between units at the boundary of clusters.' The specification is not as precise as the claims.

These claims need to be amended or withdrawn from consideration.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the

> prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 12, 13, 18-21, 26-30, 35-38, 43, 44, 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sedra in view of Fagg. (‘Microelectronic circuits’, referred to as **Sedra**; ‘Cerebellar Learning for Control of a two Link Arm in Muscle Space’, referred to as **Fagg**)

Claim 12

Sedra teaches a plurality of control circuits, each control circuit comprising the following elements (**Sedra,** p974-975, Fig 12.1; ‘Plurality of control circuits’ of applicant is disclosed by ‘amplifier A’ and ‘frequency-selective network B’ of Sedra.) an input receiving connection for receiving an input signal (**Sedra,** p974-975, Fig 12.1; ‘Input receiving connection’ of applicant is illustrated by the input of ‘X_s’ of Sedra.) an oscillation generation circuit for generating at a first output terminal an oscillation output signal having an amplitude, phase and a frequency. (**Sedra,** p974-975, Fig 12.1; The oscillator feedback loop of Sedra generates sinusoidal oscillations. It is inherent that oscillations have ‘amplitude, phase and a frequency.)

Sedra does not teach a first spike generation circuit in communication with the oscillation generation circuit for generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being

provided at the first output terminal a second spike generation circuit in communication with the oscillation generation circuit for generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal which is capable of controlling an actuating element, and wherein characteristic information of the actuating element is provided as part of the input signal to the control circuit.

Fagg teaches a first spike generation circuit in communication with the oscillation generation circuit for generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal (**Fagg,** p2638, C2:26 through p2639, C1:21; ‘First spike generation circuit’ of applicant is equivalent to the ‘adjustable pattern generators’ of Fagg. The ‘first threshold’ of applicant is disclosed by the desire to move the ‘single muscle’ of Fagg) a second spike generation circuit in communication with the oscillation generation circuit for generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal (**Fagg,** p2638, C2:26 through p2639, C1:21; ‘Second spike generation circuit’ of applicant is equivalent to the ‘extra cerebellar (EC)’ of Fagg. The ‘second threshold’ of applicant is if the arm reaches its goal or not. If the arm reached the goal, then the threshold has not been crossed. If the arm did not reach the goal, then the threshold has been crossed of Fagg) wherein the oscillation output signal, the

first spike signal and the second spike signal collectively form a composite output signal (**Fagg,** p2638, C2:26 through p2639, C1:21; The combination of the spike signals and the oscillation signal of applicant is disclosed by 'The combination of the two control modules are combined in the spinal/muscle system which transforms muscle space signals into joint torques' of Fagg.) which is capable of controlling an actuating element, and wherein characteristic information of the actuating element is provided as part of the input signal to the control circuit. (**Fagg,** p2638, C2:11 through p2639, C1:21; Controlling a 'actuating element' of applicant is equivalent to 'planer arm' of Fagg. 'Characteristic information' as 'part of the input signal to the control circuit' of applicant is disclosed by the inferior olive function as estimating movement errors which are then used to update the APG of Fagg.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by using one circuit to move an arm and a second circuit to make corrections as taught by Fagg to have a first spike generation circuit in communication with the oscillation generation circuit for generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal a second spike generation circuit in communication with the oscillation generation circuit for generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal which is capable

of controlling an actuating element, and wherein characteristic information of the actuating element is provided as part of the input signal to the control circuit.

For the purpose of using the second circuit to train the first circuit to increase movement efficiently.

Sedra teaches to thereby adjust one of the amplitude and frequency of the oscillation output signal. (**Sedra,** p974-975, Fig 12.1; ‘Amplitude’ of applicant is controlled by ‘amplifier’ of Sedra. ‘Frequency’ of applicant is controlled by ‘frequency-selective’ of Sedra.)

Sedra does not teach phase

Fagg teaches phase. (**Fagg,** abstract; ‘Phase’ of applicant is disclosed by ‘This model uses the combination delayed sensory signals and …’ of Fagg.) It would have been obvious to a person having ordinary skill in the art at the time of applicant’s invention to modify the teachings of Sedra by changing the phase as taught by Fagg to have phase.

For the purpose of putting various oscillations into synchronous behavior for improved movement.

Claim 13

Sedra does not teach wherein a phase characteristic of the composite output signal of a first control circuit is maintained at a predetermined level relative to a phase characteristic of the composite output signal of a second control circuit.

Fagg teaches wherein a phase characteristic of the composite output signal of a first control circuit is maintained at a predetermined level relative to a phase characteristic of the composite output signal of a second control circuit. (**Fagg,** p2638, C2:11 through p2639, C1:21; The 'output signal of a first control circuit is maintained at a predetermined level relative to a phase characteristic of the composite output signal of a second control circuit' of applicant is disclosed by the adjustable pattern generators functions with or without input from the extra-cerebellar module. The extra-cerebellar only becomes active when the arm does not reach it goal.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by having independent output signals as taught by Fagg to have wherein a phase characteristic of the composite output signal of a first control circuit is maintained at a predetermined level relative to a phase characteristic of the composite output signal of a second control circuit.

For the purpose of having a different signal for correcting the movement of an arm.

Claim 18

Sedra does not teach a command input for controlling the coupling between control circuits.

Fagg teaches a command input for controlling the coupling between control circuits. (**Fagg,** p2638, C2:11 through p2639, C1:21; 'Command input' of applicant is equivalent to the 'adjustable pattern generators each of which drive a

single muscle' of Fagg.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by having adjustable input as taught by Fagg to have a command input for controlling the coupling between control circuits.

For the purpose of being able to modify the circuits performance for improved results.

Claim 19

Sedra does not teach a first cluster of control circuits and a second cluster of control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster.

Fagg teaches a first cluster of control circuits and a second cluster of control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster. (**Fagg,** p2638, C2:26 through p2639, C1:21; 'First spike generation circuit' of applicant is equivalent to the 'adjustable pattern generators' of Fagg. The 'first threshold' of applicant is disclosed by the desire to move the 'single muscle' of Fagg. This operates regardless of input from the extra cerebellar. Thus there is a lower degree of coupling between the first and second circuits. The coupling within the first circuit is higher due to the specific function of

movement of an arm is associated with the adjustable pattern generator.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by having clusters acting semi-independently with other clusters as taught by Fagg to have a first cluster of control circuits and a second cluster of control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster.

For the purpose of having clusters perform a given function with some coordination among other clusters for improved performance.

Claim 20

Sedra teaches a plurality of control circuits, each control circuit comprising the following elements (**Sedra,** p974-975, Fig 12.1; 'Plurality of control circuits' of applicant is disclosed by 'amplifier A' and 'frequency-selective network B' of Sedra.) an input receiving connection for receiving an input signal (**Sedra,** p974-975, Fig 12.1; 'Input receiving connection' of applicant is illustrated by the input of 'X_s' of Sedra.) an oscillation generation circuit for generating at a first output terminal and a second output terminal an oscillation output signal having an amplitude, phase and a frequency. (**Sedra,** p974-975, Fig 12.1; The oscillator feedback loop of Sedra generates sinusoidal oscillations. It is inherent that oscillations have 'amplitude, phase and a frequency.)

Sedra does not teach a first spike generation circuit in communication with the oscillation generation circuit for generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal and the second output terminal a second spike generation circuit in communication with the oscillation generation circuit for generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a first composite output signal at the first output terminal, and the oscillation output signal and the first spike signal collectively form a second composite output signal at the second output terminal such that at least one of the composite output signals is capable of controlling an actuating element, and wherein characteristic information of the actuating element is provided as part of the input signal to the control circuit.

Fagg teaches a first spike generation circuit in communication with the oscillation generation circuit for generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal and the second output terminal (**Fagg,** p2638, C2:26 through p2639, C1:21; 'First spike generation circuit' of applicant is equivalent to the 'adjustable pattern generators' of Fagg. The 'first threshold' of applicant is disclosed by the desire to move the 'single muscle' of Fagg) a second spike generation circuit in communication with the oscillation generation circuit for

generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal (**Fagg,** p2638, C2:26 through p2639, C1:21; 'Second spike generation circuit' of applicant is equivalent to the 'extra cerebellar (EC)' of Fagg. The 'second threshold' of applicant is if the arm reaches its goal or not. If the are reached the goal, then the threshold has not been crossed. If the arm did not reach the goal, then the threshold has been crossed of Fagg) wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a first composite output signal at the first output terminal, and the oscillation output signal and the first spike signal collectively form a second composite output signal at the second output terminal (**Fagg,** p2638, C2:26 through p2639, C1:21; The combination of the spike signals and the oscillation signal of applicant is disclosed by 'The combination of the two control modules are combined in the spinal/muscle system which transforms muscle space signals into joint torques' of Fagg.) such that at least one of the composite output signals is capable of controlling an actuating element, and wherein characteristic information of the actuating element is provided as part of the input signal to the control circuit. (**Fagg,** p2638, C2:11 through p2639, C1:21; Controlling a 'actuating element' of applicant is equivalent to 'planer arm' of Fagg. 'Characteristic information' as 'part of the input signal to the control circuit' of applicant is disclosed by the inferior olive function as estimating movement errors which are then used to update the APG of Fagg.) It would have been obvious to a person having

ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by using one circuit to move an arm and a second circuit to make corrections as taught by Fagg to have a first spike generation circuit in communication with the oscillation generation circuit for generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal and the second output terminal a second spike generation circuit in communication with the oscillation generation circuit for generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a first composite output signal at the first output terminal, and the oscillation output signal and the first spike signal collectively form a second composite output signal at the second output terminal such that at least one of the composite output signals is capable of controlling an actuating element, and wherein characteristic information of the actuating element is provided as part of the input signal to the control circuit.

For the purpose of using the second circuit to train the first circuit to increase movement efficiently.

Sedra teaches to thereby adjust one of the amplitude and frequency of the oscillation output signal. (**Sedra,** p974-975, Fig 12.1; 'Amplitude' of applicant is controlled by 'amplifier' of Sedra. 'Frequency' of applicant is controlled by 'frequency-selective' of Sedra.)

Sedra does not teach phase.

Fagg teaches phase. (**Fagg,** abstract; 'Phase' of applicant is disclosed by 'This model uses the combination delayed sensory signals and …' of Fagg.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by changing the phase as taught by Fagg to have phase. (copy what the applicant claims).

For the purpose of putting various oscillations into synchronous behavior for improved movement.

Claim 21

Sedra does not teach wherein a phase characteristic of the composite output signal of a first control circuit is maintained at a predetermined level relative to a phase characteristic of the composite output signal of a second control circuit.

Fagg teaches wherein a phase characteristic of the composite output signal of a first control circuit is maintained at a predetermined level relative to a phase characteristic of the composite output signal of a second control circuit. (**Fagg,** p2638, C2:11 through p2639, C1:21; The 'output signal of a first control circuit is maintained at a predetermined level relative to a phase characteristic of the composite output signal of a second control circuit' of applicant is disclosed by the adjustable pattern generators functions with or without input from the extra-cerebellar module. The extra-cerebellar only becomes active when the arm does not reach it goal.) It would have been obvious to a person having ordinary

skill in the art at the time of applicant's invention to modify the teachings of Sedra by having independent output signals as taught by Fagg to have wherein a phase characteristic of the composite output signal of a first control circuit is maintained at a predetermined level relative to a phase characteristic of the composite output signal of a second control circuit.

For the purpose of having a different signal for correcting the movement of an arm.

Claim 26

Sedra does not teach a command input for controlling the coupling between control circuits.

Fagg teaches a command input for controlling the coupling between control circuits. (**Fagg,** p2638, C2:11 through p2639, C1:21; 'Command input' of applicant is equivalent to the 'adjustable pattern generators each of which drive a single muscle' of Fagg.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by having adjustable input as taught by Fagg to have a command input for controlling the coupling between control circuits.

For the purpose of being able to modify the circuits performance for improved results.

Claim 27

Sedra does not teach a first cluster of control circuits and a second cluster of control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster.

Fagg teaches a first cluster of control circuits and a second cluster of control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster. (**Fagg,** p2638, C2:26 through p2639, C1:21; 'First spike generation circuit' of applicant is equivalent to the 'adjustable pattern generators' of Fagg. The 'first threshold' of applicant is disclosed by the desire to move the 'single muscle' of Fagg. This operates regardless of input from the extra cerebellar. Thus there is a lower degree of coupling between the first and second circuits. The coupling within the first circuit is higher due to the specific function of movement of an arm is associated with the adjustable pattern generator.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by having clusters acting semi-independently with other clusters as taught by Fagg to have a first cluster of control circuits and a second cluster of control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster.

For the purpose of having clusters perform a given function with some coordination among other clusters for improved performance.

Claim 28

Sedra teaches a plurality of control circuits, each control circuit comprising the following elements (**Sedra,** p974-975, Fig 12.1; 'Plurality of control circuits' of applicant is disclosed by 'amplifier A' and 'frequency-selective network B' of Sedra.) an input receiving connection for receiving an input signal (**Sedra,** p974-975, Fig 12.1; 'Input receiving connection' of applicant is illustrated by the input of 'X_s' of Sedra.) an oscillation generation circuit for generating at a first output terminal an oscillation output signal having an amplitude, phase and a frequency. (**Sedra,** p974-975, Fig 12.1; The oscillator feedback loop of Sedra generates sinusoidal oscillations. It is inherent that oscillations have 'amplitude, phase and a frequency.)

Sedra does not teach a first spike generation circuit in communication with the oscillation generation circuit for generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal a second spike generation circuit in communication with the oscillation generation circuit for generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal wherein the oscillation output signal, the first spike signal and the second spike signal

collectively form a composite output signal which is capable of controlling an actuating element, and wherein a sensor is used to obtain characteristic information of the actuating element such that the characteristic information is provided as part of the input signal to the control circuit.

Fagg teaches a first spike generation circuit in communication with the oscillation generation circuit for generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal (**Fagg,** p2638, C2:26 through p2639, C1:21; 'First spike generation circuit' of applicant is equivalent to the 'adjustable pattern generators' of Fagg. The 'first threshold' of applicant is disclosed by the desire to move the 'single muscle' of Fagg) a second spike generation circuit in communication with the oscillation generation circuit for generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal (**Fagg,** p2638, C2:26 through p2639, C1:21; 'Second spike generation circuit' of applicant is equivalent to the 'extra cerebellar (EC)' of Fagg. The 'second threshold' of applicant is if the arm reaches its goal or not. If the are reached the goal, then the threshold has not been crossed. If the arm did not reach the goal, then the threshold has been crossed of Fagg) wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal (**Fagg,** p2638, C2:26 through p2639, C1:21; The combination of the spike signals and the oscillation signal of applicant is disclosed by 'The combination of the two control modules are combined in the spinal/muscle system which

transforms muscle space signals into joint torques' of Fagg.) which is capable of controlling an actuating element, and wherein a sensor is used to obtain characteristic information of the actuating element such that the characteristic information is provided as part of the input signal to the control circuit. (**Fagg,** p2638, C2:11 through p2639, C1:21; Controlling a 'actuating element' of applicant is equivalent to 'planer arm' of Fagg. 'Characteristic information' as 'part of the input signal to the control circuit' of applicant is disclosed by the inferior olive function as estimating movement errors which are then used to update the APG of Fagg.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by using one circuit to move an arm and a second circuit to make corrections as taught by Fagg to have a first spike generation circuit in communication with the oscillation generation circuit for generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal a second spike generation circuit in communication with the oscillation generation circuit for generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal which is capable of controlling an actuating element, and wherein a sensor is used to obtain characteristic information of the actuating element such that the characteristic information is provided as part of the input signal to the control circuit.

For the purpose of using the second circuit to train the first circuit to increase movement efficiently.

Sedra teaches to thereby adjust one of the amplitude and frequency of the oscillation output signal. (**Sedra,** p974-975, Fig 12.1; 'Amplitude' of applicant is controlled by 'amplifier' of Sedra. 'Frequency' of applicant is controlled by 'frequency-selective' of Sedra.)

Sedra does not teach phase and further wherein the input signal is used to synchronize controlled movement of the actuation elements.

Fagg teaches phase, (**Fagg,** abstract; 'Phase' of applicant is disclosed by 'This model uses the combination delayed sensory signals and …' of Fagg.), and further wherein the input signal is used to synchronize controlled movement of the actuation elements. (**Fagg,** abstract; 'Synchronize controlled movements' of applicant is illustrated by 'the model learns in a trial and error fashion to produce bursts of muscle activity that accurately bring the arm to a specific target' of Fagg.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by changing the phase as taught by Fagg to have phase and further wherein the input signal is used to synchronize controlled movement of the actuation elements.

For the purpose of putting various oscillations into synchronous behavior for improved movement.

Claim 29

Sedra teaches using a plurality of control circuits, each control circuit performing the following steps (**Sedra,** p974-975, Fig 12.1; 'Plurality of control circuits' of applicant is disclosed by 'amplifier A' and 'frequency-selective network B' of Sedra.) receiving an input signal at an input receiving connection (**Sedra,** p974-975, Fig 12.1; 'Input receiving connection' of applicant is illustrated by the input of 'X_s' of Sedra.) generating at a first output terminal an oscillation output signal having an amplitude and a frequency. (**Sedra,** p974-975, Fig 12.1; The oscillator feedback loop of Sedra generates sinusoidal oscillations. It is inherent that oscillations have 'amplitude, phase and a frequency.)

Sedra does not teach generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal which is capable of controlling an actuating element, and further comprising the step of obtaining characteristic information of the actuating element which is provided as part of the input signal to the control circuit.

Fagg teaches generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal (**Fagg,** p2638, C2:26 through p2639, C1:21; 'First spike generation circuit' of applicant is equivalent to the 'adjustable pattern generators' of Fagg. The 'first threshold' of applicant is disclosed by the desire to move the

'single muscle' of Fagg) generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal (**Fagg,** p2638, C2:26 through p2639, C1:21; 'Second spike generation circuit' of applicant is equivalent to the 'extra cerebellar (EC)' of Fagg. The 'second threshold' of applicant is if the arm reaches its goal or not. If the are reached the goal, then the threshold has not been crossed. If the arm did not reach the goal, then the threshold has been crossed of Fagg) wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal (**Fagg,** p2638, C2:26 through p2639, C1:21; The combination of the spike signals and the oscillation signal of applicant is disclosed by 'The combination of the two control modules are combined in the spinal/muscle system which transforms muscle space signals into joint torques' of Fagg.) which is capable of controlling an actuating element, and further comprising the step of obtaining characteristic information of the actuating element which is provided as part of the input signal to the control circuit. (**Fagg,** p2638, C2:11 through p2639, C1:21; Controlling a 'actuating element' of applicant is equivalent to 'planer arm' of Fagg. 'Characteristic information' as 'part of the input signal to the control circuit' of applicant is disclosed by the inferior olive function as estimating movement errors which are then used to update the APG of Fagg.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by using one circuit to move an arm and a second circuit to make corrections as taught by Fagg to generating a first spike signal when the

oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal which is capable of controlling an actuating element, and further comprising the step of obtaining characteristic information of the actuating element which is provided as part of the input signal to the control circuit.

For the purpose of using the second circuit to train the first circuit to increase movement efficiently.

Sedra teaches to thereby adjust one of the amplitude and frequency of the oscillation output signal. (**Sedra,** p974-975, Fig 12.1; ‘Amplitude’ of applicant is controlled by ‘amplifier’ of Sedra. ‘Frequency’ of applicant is controlled by ‘frequency-selective’ of Sedra.)

Sedra does not teach phase.

Fagg teaches phase. (**Fagg,** abstract; ‘Phase’ of applicant is disclosed by ‘This model uses the combination delayed sensory signals and …’ of Fagg.) It would have been obvious to a person having ordinary skill in the art at the time of applicant’s invention to modify the teachings of Sedra by changing the phase as taught by Fagg to have phase.

For the purpose of putting various oscillations into synchronous behavior for improved movement.

Claim 30

Sedra does not teach wherein a phase characteristic of the composite output signal of a first control circuit is maintained relative to a phase characteristic of the composite output signal of a second control circuit.

Fagg teaches wherein a phase characteristic of the composite output signal of a first control circuit is maintained relative to a phase characteristic of the composite output signal of a second control circuit. (**Fagg,** p2638, C2:11 through p2639, C1:21; The 'output signal of a first control circuit is maintained at a predetermined level relative to a phase characteristic of the composite output signal of a second control circuit' of applicant is disclosed by the adjustable pattern generators functions with or without input from the extra-cerebellar module. The extra-cerebellar only becomes active when the arm does not reach it goal.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by having independent output signals as taught by Fagg to have wherein a phase characteristic of the composite output signal of a first control circuit is maintained relative to a phase characteristic of the composite output signal of a second control circuit.

For the purpose of having a different signal for correcting the movement of an arm.

Claim 35

Sedra does not teach the step of applying a command input for controlling the coupling between control circuits.

Fagg teaches the step of applying a command input for controlling the coupling between control circuits. (**Fagg,** p2638, C2:11 through p2639, C1:21; 'Command input' of applicant is equivalent to the 'adjustable pattern generators each of which drive a single muscle' of Fagg.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by having adjustable input as taught by Fagg to have the step of applying a command input for controlling the coupling between control circuits.

For the purpose of being able to modify the circuits performance for improved results.

Claim 36

Sedra does not teach the step of creating a first cluster of control circuits and a second cluster of a control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster.

Fagg teaches the step of creating a first cluster of control circuits and a second cluster of a control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first

cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster. (**Fagg,** p2638, C2:26 through p2639, C1:21; ‘First spike generation circuit’ of applicant is equivalent to the ‘adjustable pattern generators’ of Fagg. The ‘first threshold’ of applicant is disclosed by the desire to move the ‘single muscle’ of Fagg. This operates regardless of input from the extra cerebellar. Thus there is a lower degree of coupling between the first and second circuits. The coupling within the first circuit is higher due to the specific function of movement of an arm is associated with the adjustable pattern generator.) It would have been obvious to a person having ordinary skill in the art at the time of applicant’s invention to modify the teachings of Sedra by having clusters acting semi-independently with other clusters as taught by Fagg to have the step of creating a first cluster of control circuits and a second cluster of a control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster.

For the purpose of having clusters perform a given function with some coordination among other clusters for improved performance.

Claim 37

Sedra teaches using a plurality of control circuits (**Sedra,** p974-975, Fig 12.1; ‘Plurality of control circuits’ of applicant is disclosed by ‘amplifier A’ and

'frequency-selective network B' of Sedra.), each control circuit performing the following steps: receiving an input signal at an input receiving connection (**Sedra,** p974-975, Fig 12.1; Both of the 'amplifier A' and 'frequency-selective network B' of Sedra have the ability to receive input signals.), generating at a first output terminal and at a second output terminal (**Sedra,** p974-975, Fig 12.1; One example of a 'first output terminal' of applicant is disclosed by the output of the 'amplifier A' of Sedra. An example of a second output terminal of applicant is disclosed by the output of the 'frequency-selective network B' of Sedra.) an oscillation output signal having an amplitude, phase and a frequency. (**Sedra,** p974-975, Fig 12.1; The oscillator feedback loop of Sedra generates sinusoidal oscillations. It is inherent that oscillations have 'amplitude, phase and a frequency.)

Sedra does not teach generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal and the second output terminal generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal at the first output terminal, and the oscillation output signal and the first spike signal collectively form a second composite output signal at the second output terminal such that at least one of the composite output signals is capable of controlling an actuating element, and

further comprising the step of obtaining characteristic information of the actuating element which is provided as part of the input signal to the control circuit.

Fagg teaches generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal and the second output terminal (**Fagg,** p2638, C2:26 through p2639, C1:21; 'First spike generation circuit' of applicant is equivalent to the 'adjustable pattern generators' of Fagg. The 'first threshold' of applicant is disclosed by the desire to move the 'single muscle' of Fagg) generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal (**Fagg,** p2638, C2:26 through p2639, C1:21; 'Second spike generation circuit' of applicant is equivalent to the 'extra cerebellar (EC)' of Fagg. The 'second threshold' of applicant is if the arm reaches its goal or not. If the are reached the goal, then the threshold has not been crossed. If the arm did not reach the goal, then the threshold has been crossed of Fagg) wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal at the first output terminal, and the oscillation output signal and the first spike signal collectively form a second composite output signal at the second output terminal (**Fagg,** p2638, C2:26 through p2639, C1:21; The combination of the spike signals and the oscillation signal of applicant is disclosed by 'The combination of the two control modules are combined in the spinal/muscle system which transforms muscle space signals into joint torques' of Fagg.) such that at least one of the composite output signals is capable of controlling an

actuating element, and further comprising the step of obtaining characteristic information of the actuating element which is provided as part of the input signal to the control circuit. (**Fagg,** p2638, C2:11 through p2639, C1:21; Controlling a 'actuating element' of applicant is equivalent to 'planer arm' of Fagg. 'Characteristic information' as 'part of the input signal to the control circuit' of applicant is disclosed by the inferior olive function as estimating movement errors which are then used to update the APG of Fagg.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by using one circuit to move an arm and a second circuit to make corrections as taught by Fagg to generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal and the second output terminal generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal at the first output terminal, and the oscillation output signal and the first spike signal collectively form a second composite output signal at the second output terminal such that at least one of the composite output signals is capable of controlling an actuating element, and further comprising the step of obtaining characteristic information of the actuating element which is provided as part of the input signal to the control circuit.

For the purpose of using the second circuit to train the first circuit to increase movement efficiently.

Sedra teaches to thereby adjust one of the amplitude and frequency of the oscillation output signal. (**Sedra,** p974-975, Fig 12.1; 'Amplitude' of applicant is controlled by 'amplifier' of Sedra. 'Frequency' of applicant is controlled by 'frequency-selective' of Sedra.)

Sedra does not teach phase.

Fagg teaches phase. (**Fagg,** abstract; 'Phase' of applicant is disclosed by 'This model uses the combination delayed sensory signals and …' of Fagg.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by changing the phase as taught by Fagg to have phase.

For the purpose of putting various oscillations into synchronous behavior for improved movement.

Claim 38

Sedra does not teach wherein a phase characteristic of the composite output signal of a first control circuit is maintained relative to a phase characteristic of the composite output signal of a second control circuit.

Fagg teaches wherein a phase characteristic of the composite output signal of a first control circuit is maintained relative to a phase characteristic of the composite output signal of a second control circuit. (**Fagg,** p2638, C2:11

through p2639, C1:21; The 'output signal of a first control circuit is maintained at a predetermined level relative to a phase characteristic of the composite output signal of a second control circuit' of applicant is disclosed by the adjustable pattern generators functions with or without input from the extra-cerebellar module. The extra-cerebellar only becomes active when the arm does not reach it goal.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by having independent output signals as taught by Fagg to have wherein a phase characteristic of the composite output signal of a first control circuit is maintained relative to a phase characteristic of the composite output signal of a second control circuit.

For the purpose of having a different signal for correcting the movement of an arm.

Claim 43

Sedra does not teach the step of applying a command input for controlling the coupling between control circuits.

Fagg teaches the step of applying a command input for controlling the coupling between control circuits. (**Fagg,** p2638, C2:11 through p2639, C1:21; 'Command input' of applicant is equivalent to the 'adjustable pattern generators each of which drive a single muscle' of Fagg.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by having adjustable input as taught by Fagg to have the

step of applying a command input for controlling the coupling between control circuits.

For the purpose of being able to modify the circuits performance for improved results.

Claim 44

Sedra does not teach the step of creating a first cluster of control circuits and a second cluster of a control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster.

Fagg teaches the step of creating a first cluster of control circuits and a second cluster of a control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster. (**Fagg,** p2638, C2:26 through p2639, C1:21; 'First spike generation circuit' of applicant is equivalent to the 'adjustable pattern generators' of Fagg. The 'first threshold' of applicant is disclosed by the desire to move the 'single muscle' of Fagg. This operates regardless of input from the extra cerebellar. Thus there is a lower degree of coupling between the first and second circuits. The coupling within the first circuit is higher due to the specific function of movement of an arm is associated with the adjustable pattern generator.) It would have been obvious to a person having

ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by having clusters acting semi-independently with other clusters as taught by Fagg to have the step of creating a first cluster of control circuits and a second cluster of a control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster.

For the purpose of having clusters perform a given function with some coordination among other clusters for improved performance.

Claim 46

Sedra does not teach wherein the first spike signal and the second spike signal have different amplitudes.

Fagg teaches wherein the first spike signal and the second spike signal have different amplitudes. (**Fagg,** p2638, C2:26 through p2639, C1:21; It is inherent that the second spike signal have a different amplitude than the first due to the design that the second spike signal is a correcting factor for the first spike signal. 'Second spike generation circuit' of applicant is equivalent to the 'extra cerebellar (EC)' of Fagg. The 'second threshold' of applicant is if the arm reaches its goal or not. If the are reached the goal, then the threshold has not been crossed. If the arm did not reach the goal, then the threshold has been crossed of Fagg) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the teachings of Sedra by having

different signals as taught by Fagg to have wherein the first spike signal and the second spike signal have different amplitudes.

For the purpose of using the second signal as a correction signal for the corresponding movement of the arm.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 14-17, 22-25, 31-34, 39-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sedra and Fagg in view of Nekorkin. ('Homoclinic orbits and solitary waves in a one dimensional array of Chua's circuits', referred to as **Nekorkin**)

Claim 14

Sedra and Fagg do not teach at least one coupling element for coupling adjacent control circuits.

Nekorkin teaches at least one coupling element for coupling adjacent control circuits. (**Nekorkin,** p785, C1:1 through p786 C2:23; 'Coupling element for coupling adjacent control circuits' of applicant is illustrated by 'dynamics of coupled electronic oscillators' and 'The parameter d characterizes the strength of the coupling between the elements' of Nekorkin.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Sedra and Fagg by having a link between adjacent neurons as taught by Nekorkin to have at least one coupling element for coupling adjacent control circuits.

Based on the assumption that adjacent neurons relate to adjacent engines, coupled neurons relate to coordination between neurons.

Claim 15

Sedra and Fagg do not teach wherein the coupling element comprises a variable impedance element.

Nekorkin teaches wherein the coupling element comprises a variable impedance element. (**Nekorkin,** p785, C1:1 through p786 C2:23; 'Variable impedance element' of applicant is equivalent to 'The nonlinear function f(x) describes the three segment piecewise linear resistor characteristic g(V).' of Nekorkin.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Sedra

and Fagg by having a variable input for coupling as taught by Nekorkin to have wherein the coupling element comprises a variable impedance element.

For the purpose of reducing or increasing the coordination between the neurons to achieve the task at hand.

Claim 16

Sedra and Fagg do not teach a plurality of coupling elements, each coupling element connected to two adjacent control circuits to thereby provide coupling between the two adjacent control circuits.

Nekorkin teaches a plurality of coupling elements, each coupling element connected to two adjacent control circuits to thereby provide coupling between the two adjacent control circuits. (**Nekorkin,** p785, abstract; ‘Plurality of coupling elements’ of applicant is disclosed by ‘models of coupled nonlinear oscillators’ of Nekorkin.) It would have been obvious to a person having ordinary skill in the art at the time of applicant’s invention to modify the combined teachings of Sedra and Fagg by having a connection between neurons as taught by Nekorkin to have a plurality of coupling elements, each coupling element connected to two adjacent control circuits to thereby provide coupling between the two adjacent control circuits.

For the purpose of being able to establish a link between two neurons for improving a coordination effort for the task at hand.

Claim 17

Sedra and Fagg do not teach wherein the impedance of the coupling elements is altered to thereby modify synchronization between coupled control circuits.

Nekorkin teaches wherein the impedance of the coupling elements is altered to thereby modify synchronization between coupled control circuits. (**Nekorkin,** p785, abstract; ‘Modify synchronization between coupled control circuits’ of applicant is disclosed by the study of nonlinear synchronization arrays and arrays of electronic oscillators of Nekorkin.) It would have been obvious to a person having ordinary skill in the art at the time of applicant’s invention to modify the combined teachings of Sedra and Fagg by using coupling to establish synchronization as taught by Nekorkin to have wherein the impedance of the coupling elements is altered to thereby modify synchronization between coupled control circuits.

For the purpose of obtaining synchronization between neurons.

Claim 22

Sedra and Fagg do not teach at least one coupling element for coupling adjacent control circuits.

Nekorkin teaches at least one coupling element for coupling adjacent control circuits. (**Nekorkin,** p785, C1:1 through p786 C2:23; ‘Coupling element for coupling adjacent control circuits’ of applicant is illustrated by ‘dynamics of

coupled electronic oscillators' and 'The parameter d characterizes the strength of the coupling between the elements' of Nekorkin.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Sedra and Fagg by having a link between adjacent neurons as taught by Nekorkin to have at least one coupling element for coupling adjacent control circuits.

Based on the assumption that adjacent neurons relate to adjacent engines, coupled neurons relate to coordination between neurons.

Claim 23

Sedra and Fagg do not teach wherein the coupling element comprises a variable impedance element.

Nekorkin teaches wherein the coupling element comprises a variable impedance element. (**Nekorkin,** p785, C1:1 through p786 C2:23; 'Variable impedance element' of applicant is equivalent to 'The nonlinear function f(x) describes the three segment piecewise linear resistor characteristic g(V).' of Nekorkin.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Sedra and Fagg by having a variable input for coupling as taught by Nekorkin to have wherein the coupling element comprises a variable impedance element.

For the purpose of reducing or increasing the coordination between the neurons to achieve the task at hand.

Claim 24

Sedra and Fagg do not teach a plurality of coupling elements, each coupling element connected to two adjacent control circuits to thereby provide coupling between the two adjacent control circuits.

Nekorkin teaches a plurality of coupling elements, each coupling element connected to two adjacent control circuits to thereby provide coupling between the two adjacent control circuits. (**Nekorkin,** p785, abstract; 'Plurality of coupling elements' of applicant is disclosed by 'models of coupled nonlinear oscillators' of Nekorkin.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Sedra and Fagg by having a connection between neurons as taught by Nekorkin to have a plurality of coupling elements, each coupling element connected to two adjacent control circuits to thereby provide coupling between the two adjacent control circuits.

For the purpose of being able to establish a link between two neurons for improving a coordination effort for the task at hand.

Claim 25

Sedra and Fagg do not teach wherein the impedance of the coupling elements is altered to thereby modify synchronization between coupled control circuits.

Nekorkin teaches wherein the impedance of the coupling elements is altered to thereby modify synchronization between coupled control circuits. (**Nekorkin,** p785, abstract; 'Modify synchronization between coupled control circuits' of applicant is disclosed by the study of nonlinear synchronization arrays and arrays of electronic oscillators of Nekorkin.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Sedra and Fagg by using coupling to establish synchronization as taught by Nekorkin to have wherein the impedance of the coupling elements is altered to thereby modify synchronization between coupled control circuits.

For the purpose of obtaining synchronization between neurons.

Claim 31

Sedra and Fagg do not teach the step of using at least one coupling element for coupling adjacent control circuits.

Nekorkin teaches the step of using at least one coupling element for coupling adjacent control circuits. (**Nekorkin,** p785, C1:1 through p786 C2:23; 'Coupling element for coupling adjacent control circuits' of applicant is illustrated by 'dynamics of coupled electronic oscillators' and 'The parameter d characterizes the strength of the coupling between the elements' of Nekorkin.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Sedra and Fagg by

having a link between adjacent neurons as taught by Nekorkin to have the step of using at least one coupling element for coupling adjacent control circuits.

Based on the assumption that adjacent neurons relate to adjacent engines, coupled neurons relate to coordination between neurons.

Claim 32

Sedra and Fagg do not teach wherein the coupling element comprises a variable impedance element

Nekorkin teaches wherein the coupling element comprises a variable impedance element. (**Nekorkin,** p785, C1:1 through p786 C2:23; 'Variable impedance element' of applicant is equivalent to 'The nonlinear function f(x) describes the three segment piecewise linear resistor characteristic g(V).' of Nekorkin.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Sedra and Fagg by having a variable input for coupling as taught by Nekorkin to have wherein the coupling element comprises a variable impedance element

For the purpose of reducing or increasing the coordination between the neurons to achieve the task at hand.

Claim 33

Sedra and Fagg do not teach the step of using a plurality of coupling elements, each coupling element connected to two adjacent control circuits to thereby provide coupling between the two adjacent control circuits.

Nekorkin teaches the step of using a plurality of coupling elements, each coupling element connected to two adjacent control circuits to thereby provide coupling between the two adjacent control circuits. (**Nekorkin,** p785, abstract; 'Plurality of coupling elements' of applicant is disclosed by 'models of coupled nonlinear oscillators' of Nekorkin.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Sedra and Fagg by having a connection between neurons as taught by Nekorkin to have the step of using a plurality of coupling elements, each coupling element connected to two adjacent control circuits to thereby provide coupling between the two adjacent control circuits.

For the purpose of being able to establish a link between two neurons for improving a coordination effort for the task at hand.

Claim 34

Sedra and Fagg do not teach the step of altering the impedance to thereby modify synchronization between coupled control circuits.

Nekorkin teaches the step of altering the impedance to thereby modify synchronization between coupled control circuits. (**Nekorkin,** p785, abstract; 'Modify synchronization between coupled control circuits' of applicant is disclosed by the study of nonlinear synchronization arrays and arrays of electronic

oscillators of Nekorkin.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Sedra and Fagg by using coupling to establish synchronization as taught by Nekorkin to have the step of altering the impedance to thereby modify synchronization between coupled control circuits.

For the purpose of obtaining synchronization between neurons.

Claim 39

Sedra and Fagg do not teach the step of using at least one coupling element for coupling adjacent control circuits.

Nekorkin teaches the step of using at least one coupling element for coupling adjacent control circuits. (**Nekorkin,** p785, C1:1 through p786 C2:23; 'Coupling element for coupling adjacent control circuits' of applicant is illustrated by 'dynamics of coupled electronic oscillators' and 'The parameter d characterizes the strength of the coupling between the elements' of Nekorkin.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Sedra and Fagg by having a link between adjacent neurons as taught by Nekorkin to have the step of using at least one coupling element for coupling adjacent control circuits.

Based on the assumption that adjacent neurons relate to adjacent engines, coupled neurons relate to coordination between neurons.

Claim 40

Sedra and Fagg do not teach the coupling element comprises a variable impedance element.

Nekorkin teaches the coupling element comprises a variable impedance element. (**Nekorkin,** p785, C1:1 through p786 C2:23; 'Variable impedance element' of applicant is equivalent to 'The nonlinear function f(x) describes the three segment piecewise linear resistor characteristic g(V).' of Nekorkin.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Sedra and Fagg by having a variable input for coupling as taught by Nekorkin to have the coupling element comprises a variable impedance element.

For the purpose of reducing or increasing the coordination between the neurons to achieve the task at hand.

Claim 41

Sedra and Fagg do not teach the step of using a plurality of coupling elements, each coupling element connected to two adjacent control circuits to thereby provide coupling between the two adjacent control circuits.

Nekorkin teaches the step of using a plurality of coupling elements, each coupling element connected to two adjacent control circuits to thereby provide coupling between the two adjacent control circuits. (**Nekorkin,** p785, abstract; 'Plurality of coupling elements' of applicant is disclosed by 'models of coupled nonlinear oscillators' of Nekorkin.) It would have been obvious to a person having

ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Sedra and Fagg by having a connection between neurons as taught by Nekorkin to have the step of using a plurality of coupling elements, each coupling element connected to two adjacent control circuits to thereby provide coupling between the two adjacent control circuits.

For the purpose of being able to establish a link between two neurons for improving a coordination effort for the task at hand.

Claim 42

Sedra and Fagg do not teach the step of altering the impedance to thereby modify synchronization between coupled control circuits.

Nekorkin teaches the step of altering the impedance to thereby modify synchronization between coupled control circuits. (**Nekorkin,** p785, abstract; 'Modify synchronization between coupled control circuits' of applicant is disclosed by the study of nonlinear synchronization arrays and arrays of electronic oscillators of Nekorkin.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined teachings of Sedra and Fagg by using coupling to establish synchronization as taught by Nekorkin to have the step of altering the impedance to thereby modify synchronization between coupled control circuits.

For the purpose of obtaining synchronization between neurons.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sedra and Fagg in view of Gontowski. ('U. S. Patent 4720689', referred to as **Gontowski**)

Claim 45

Sedra and Fagg do not teach wherein the first spike generation circuit generates the first spike signal at a peak of the oscillation output signal.

Gontowski teaches wherein the first spike generation circuit generates the first spike signal at a peak of the oscillation output signal. (**Gontowski,** C7:50 through C8:13; 'Spike signal at a peak of the oscillation output' of applicant is equivalent to 'spike or pulse is formed at the peaks and valleys of the timing capacitor' of Gontowski.) It would have been obvious to a person having ordinary skill in the art at the time of applicant's invention to modify the combined

teachings of Sedra and Fagg by having the spike be generated at the peak of the oscillation cycle as taught by Gontowski to have wherein the first spike generation circuit generates the first spike signal at a peak of the oscillation output signal.

For the purpose to mimic a biological system with an established performance envelope.

Response to Arguments

6. Applicant's arguments filed on March 11, 2009 for claims 12-46 have been fully considered but are not persuasive.

7. In reference to the Applicant's argument:

Rejections Under 35 U.S.C. § 112.

Claims 19, 27, 36 and 44 stand rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. Applicants respectfully traverse these rejections.

Claims 19, 27, 36 and 44 require "a first cluster of control circuits and a second cluster of control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster." According to the Examiner, these claims fail to satisfy the written description requirement because the specification, which states "[g]enerally, the coupling between units inside a cluster is stronger than between units at the boundary of clusters," is not as precise as the claims. (Detailed Action, Page 3).

The claims of the present invention are directed to a model of the inferior olive

neuron. With respect to the inferior olive neuron, the specification makes clear that "[a]s the coupling among neurons increases, the degree of synchronization of the neurons increases. As has been experimentally observed, closely coupled IO neurons form oscillatory clusters." (Specification, Page 27, Lines 5-7). Thus, inferior olive neurons form clusters when closely coupled. Because cluster formation is a function of the degree of coupling between neurons, it follows that neurons within a cluster are more closely coupled to other neurons within the same cluster than they are to neurons in a different cluster. Claims 19, 27, 36, and 44 are directed to this feature of the neuron model. Accordingly, Applicants submit that these claims comply with the written description requirement.

Examiner's response:

The argument that the application parallels the inferior olive neuron and the inferior olive neuron has the stated property, does not describe in detail how this is achieved. The specification states 'generally the couple between units inside a cluster is stronger than between units at the boundary of clusters.' The Examiner has no idea what the term 'generally' means in this instance. There is no algorithm, method or system stated which sets the guidelines of 'generally.'

8. In reference to the Applicant's argument:

IV. <u>Rejections Under 35 U.S.C. § 103</u>

Claims 12, 13, 18-21, 26-30, 35-38, 43, 44 and 46 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over "Microelectronic circuits" by Sedra et al. ("Sedra") in view of "Cerebellar Learning for Control of a two Link Arm in Muscle Space" by Fagg et al. ("Fagg"). Applicants respectfully traverse these rejections.

Claims 14-17, 22-25, 31-34, 39-42 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Sedra and Fagg in view of "Homoclinic orbits and solitary waves in a one dimensional array of Chua's circuits" by Nekorkin et al. ("Nekorkin"). Applicants respectfully traverse these rejections.

Claim 45 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over

the combination of Sedra and Fagg in view of U.S. Patent No. 4,720,689 to Gontowski ("Gontowski"). Applicants respectfully traverse these rejections.

As discussed during the Examiner interview held on February 5, 2009, claim 12 is directed to a circuit for controlling an actuator. The control circuit generates an oscillation output signal. When the oscillation output signal crosses a first threshold, the control circuit generates a first spike. Similarly, when the oscillation output signal crosses a second threshold, the circuit generates a second spike. The oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal which is capable of controlling an actuating element. Additionally, characteristic information of the actuating element is provided as part of the input signal to the control circuit to thereby adjust one of the amplitude, phase and frequency of the oscillation output signal. Thus, feedback is provided to the control circuit so that the control circuit can adjust the composite signal in response to the state of the controlled actuating element.

Spike generation is dependent upon the frequency of the oscillation signal and the threshold levels. "[T]he firing frequency of the IO neurons is limited by the frequency of the sub-threshold oscillations as the action potential is generated only at voltages near the peak of the oscillation." (Specification, Page 18, Lines 17-19). However, "the firing frequency can be tuned with the parameters Ii and I2 of Eqs. 2a, 2b and 3a, 3b whose values move the base line of the sub-threshold oscillations up or down with respect to the spike firing thresholds." (Specification, Page 18, Lines 15-17).

Generation of spikes when the oscillation signal crosses a threshold is described, for example, in Page 17, Line 6 - Page 18, Line 22 of the Specification. "At rest, the oscillations of the membrane potential are below the spike-inducing threshold." (Specification, Page 17, Lines 10-11). Spiking occurs when the membrane of the IO neuron is depolarized to the point at which the threshold for spiking is met. (Specification, Page 17, Lines 15-17). Spikes due to depolarization are generated by the high-threshold pulse generator 12: "[t]he spiking is generated by the high-
threshold pulse generator ...." (Specification, Page 17, Lines 17-18). "[I]n addition to firing at
depolarized levels, the IO neuron model 10 also fires at hyperpolarized levels ....
" (Specification, Page 17, Lines 20-21). "In the case of hyperpolarization, the low threshold spikes are generated by the activation of the [low-threshold] pulse generator 13." (Specification, Page 18, Lines 3-5). Thus, spikes are fired by the high-threshold pulse generator 12 when the oscillating signal crosses a first threshold, and are fired by the low-threshold pulse generator 13 when the oscillation signal crosses a second threshold.

Examples of composite signals including an oscillation signal and spikes

according to an exemplary model of the present invention can be found in Figs. 5 and 6 of the Specification. Fig. 5A illustrates the output of an exemplary model of the present invention for a depolarized condition, which corresponds to the oscillation signal crossing the first threshold. Fig. 6A illustrates the output of an exemplary model of the present invention for a hyperpolarized condition, which corresponds to the oscillation signal crossing the second threshold. Note that the labeling of the first threshold and the second threshold in the description above is arbitrary.

With respect to independent claim 12, the Examiner contends that Sedra teaches a plurality of control circuits comprising an input receiving connection for receiving an input signal and an oscillation generation circuit for generating at a first output terminal an oscillation output signal having an amplitude, a phase, and a frequency. (Detailed Action, Page 4). The Examiner further contends that Sedra discloses adjusting the amplitude and the frequency of the oscillation output signal. (Detailed Action, Page 7). The Examiner admits that Sedra does not teach the remaining claim limitations, but contends that Fagg discloses these limitations. (Detailed Action, Page 4).

As discussed during the Examiner interview held on February 5, 2009, Applicants respectfully disagree with the Examiner's contention that the combination of Sedra and Fagg discloses all of the limitations of claim 12.

Applicants submit that Fagg discloses a model for simulating the movement of an ann. Arm movements are controlled by two different control modules and an inferior olive module (Fagg, Pages 2638-2639). The first control module is the cerebellar module, which is constructed from an array of adjustable pattern generators ("APGs"), each of which drives a single muscle. (Fagg, Page 2638). The cerebellar module is a learning module that is primarily responsible for moving the arm to a goal. (Fagg, Pages 2638-2639) The second control module is the Extra-Cerebellar ("EC") module, which is responsible for moving the arm to the goal when the cerebellar module fails to move the arm close enough to the goal. (Fagg, Page 2639). When activated, the EC module produces a short constant burst of activity in muscle space that brings the arm closer to the goal. (Fagg, Page 2639). The inferior olive estimates movement errors by observing muscle length changes in response to corrective motor commands generated by the EC module. (Fagg, Page 2639). This error information is used to update the APGs. (Fagg, Page 2639). Ideally, after a number of attempts and as a result of this learning process, the cerebellar module can move the arm to the goal without the help of the EC module.

According to the Examiner, Fagg teaches "a first spike generation circuit in communication with the oscillation generation circuit for generating a first spike signal when the oscillation output signal crosses a first threshold value," as required by claim 12. (Detailed Action, Page 5). Specifically, the Examiner

contends that the APG of Fagg is equivalent to the first spike generation circuit. (Detailed Action, Page 5). The Examiner also states that "[t]he 'first threshold' of applicant is disclosed by the desire to move the 'single muscle' of Fagg." (Detailed Action, Page 5).

Applicants respectfully submit that, contrary to the Examiner's contention, the APG of Fagg is not a spike generator. Figures 5 and 7 of Fagg illustrate the signals that drive the muscles that move the arm. (Fagg, Pages 2642-2643). Figs. 5 and 7 of Fagg are reproduced below for the convenience of the Examiner. As can be seen from these figures, the signals APG(a)-APG(f), are not comprised of spikes, but instead vary smoothly with no discernable pattern.

Examiner's response:

The applicant argues an 'oscillation generation circuit' in claims 12, 20 and 28. This is not mentioned within the specification. The Examiner disagrees with the Applicant's argument and considers the APG a spike generator. Figure 5 supplied by Applicant discloses numerous types of spikes in which the APG generates. Office Action stands.

9. In reference to the Applicant's argument:

Further, Applicants respectfully submit that the Examiner mischaracterizes the "first threshold" requirement of claim 12. The first and second thresholds of claim 12 correspond to signal levels that the output of an oscillation circuit crosses. The output of a circuit is a signal having a voltage and a current, and thus, the threshold corresponds to a signal level associated with either the voltage or current of the signal. In contrast, the Examiner's contention is that the first threshold corresponds to a desire to move a single muscle of the modeled arm. (Detailed Action, Page 5). A desire to move a muscle is not the same as the first threshold required by claim 12.

According to the Examiner, Fagg also teaches "a second spike generation circuit in communication with the oscillation generation circuit for generating a second spike signal when the oscillation output signal crosses a second threshold value," as required by claim 12. (Detailed Action, Page 5). Specifically, the Examiner contends that the EC module of Fagg is equivalent to the second spike

generation circuit. (Detailed Action, Page 5). The Examiner also states that "[t]he 'second threshold' of applicant is if the arm reaches its goal or not. If the arm reached the goal, then the threshold has not been crossed. If the arm did not reach the goal, then the threshold has been crossed." (Detailed Action, Page 5).

Although the bursts generated by the EC module, which are illustrated in Fig. 5, may be viewed as spike signals, Applicants respectfully submit that the Examiner mischaracterizes the second threshold requirement of claim 12. As discussed above with respect to the first threshold, the second threshold of claim 12 corresponds to a particular signal level that an oscillation output signal crosses. The threshold pointed to by the Examiner, i.e., whether the arm reached the goal, is not the same type of threshold as contemplated by the claimed invention.

In light of the foregoing, Applicants respectfully submit that the combination of Sedra and Fagg does not disclose each of the limitations of independent claim 12, and thus, independent claim 12 is patentable over the cited references. Accordingly, Applicants request that the rejection be withdrawn.

Applicants further submit that independent claims 20, 28, 29, and 37 are also patentable over the cited references. Claims 20 and 28, like claim 12, each require first and second spike generation circuits that generate spikes when an oscillation output signal crosses a first and a second threshold respectively. Similarly, claims 29 and 37, which are directed to methods, include the steps of generating a first and a second spike signal when an oscillation output signal crosses a first and a second threshold respectively. Therefore, the foregoing arguments with respect to claim 12 are equally applicable to these claims. Thus, Applicants respectfully submit that the combination of Sedra and Fagg does not disclose each of the limitations of independent claims 20, 28, 29, and 37, and thus, these claims are patentable over the cited references. Accordingly, Applicants request that these rejections be withdrawn.

In light of the foregoing remarks, Applicants submit that the cited references fail to disclose, teach, or suggest the features of claims 12, 20, 28, 29, and 37. Applicants further submit that claims 13-19, 21-27, 30-36, and 38-42, which are dependent upon one of claims 12, 20, 28, 29, and 37, are allowable at least by reason of dependency upon an allowable base claim. Consequently, Applicants submit that the present invention is both novel and inventive over the cited references and respectfully request that the rejections be withdrawn.

Examiner's response:

Applicant argues that 'A desire to move a muscle is not the same as the first threshold required by claim 12.' The Examiner disagrees. The claim

language to very broad and the Examiner's cited art gives an example of a ‘first threshold.’ The Examiner contends that the desire to move a muscle is equivalent to a ‘first threshold.’ Regarding the second threshold, the Applicant argues ‘the arm reached the goal, is not the same type of threshold as contemplated by the claimed invention.’ The Examiner disagrees based on the application is concept based while the cited art is example based. The Examiner views these two as parallel. Office Action stands.

Examination Considerations

10. The claims and only the claims form the metes and bounds of the invention. “Office personnel are to give the claims their broadest reasonable interpretation in light of the supporting disclosure. *In re Morris*, 127 F.3d 1048, 1054-55, 44USPQ2d 1023, 1027-28 (Fed. Cir. 1997). Limitations appearing in the specification but not recited in the claim are not read into the claim. *In re Prater*, 415 F.2d, 1393, 1404-05, 162 USPQ 541, 550-551 (CCPA 1969)” (MPEP p 2100-8, c 2, l 45-48; p 2100-9, c 1, l 1-4). The Examiner has the full latitude to interpret each claim in the broadest reasonable sense. Examiner will reference prior art using terminology familiar to one of ordinary skill in the art. Such an approach is broad in concept and can be either explicit or implicit in meaning.

11. Examiner’s Notes are provided to assist the applicant to better understand the nature of the prior art, application of such prior art and, as appropriate, to

further indicate other prior art that maybe applied in other office actions. Such comments are entirely consistent with the intent and sprit of compact prosecution. However, and unless otherwise stated, the Examiner's Notes are not prior art but link to prior art that one of ordinary skill in the art would find inherently appropriate.

12. Examiner's Opinion: Paragraphs 10 and 11 apply. The Examiner has full latitude to interpret each claim in the broadest reasonable sense.

Conclusion

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will

the statutory period for reply expire later than SIX MONTHS from the date of this final action.

14. Claims 12-46 are rejected.

Correspondence Information

15. Any inquiry concerning this information or related to the subject disclosure should be directed to the Examiner Peter Coughlan, whose telephone number is (571) 272-5990. The Examiner can be reached on Monday through Friday from 7:15 a.m. to 3:45 p.m.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor David Vincent can be reached at (571) 272-3080. Any response to this office action should be mailed to:

Commissioner of Patents and Trademarks,

Washington, D. C. 20231;

Hand delivered to:

Receptionist,

Customer Service Window,

Randolph Building,

401 Dulany Street,

Alexandria, Virginia 22313,

(located on the first floor of the south side of the Randolph Building);

or faxed to:

(571) 272-3150 (for formal communications intended for entry.)

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/P. C./

Examiner, Art Unit 2129

Peter Coughlan

5/18/2009

/David R Vincent/

Supervisory Patent Examiner, Art Unit 2129